MRK960 User Manual

Wideband True Diversity Dual Receiver

Rev.04 (ref. FW 1.1.0.u)

Date: 15 January 2014

Brief description

The MRK960 is a high performance microphone system suitable for **broadcast and high professional** application. Thanks to its exceptional selectivity and intermodulation immunity, MRK960 is able to operate even in the presence of very high DVTB-T transmitter's signals.
The **extreme bandwidth agility of 370 MHz** allows you to always find & work on the best frequencies available. MRK960 is designed to be:

- "**easy & quick to use**" thanks to automatic setup functions (i.e. frequencies, squelch), remote configuration utilities (USB/Ethernet), a display with intuitive context menu navigation.
- "**extremely flexible**", with an incredible frequency agility of 370 MHz; more than one rack can be connected together thru a simple USB cable to act a multi-channel receiver. Moreover the DSP board allows the units to work with several digital audio outputs (i.e. AES/EBU, Ethersound, …), with multi-companding compatibilities and other digital features.
- "**best in class performances**", thanks to the latest Wisycom technology the unit has extreme RF sensitivity and immunity and superb audio quality.
- "**a durable & upgradable investment**", thanks to the very robust design (aluminum housing) and the possibility of upgrade/enhance units performances with simple slot in card (pc-like thru the DEXB expansion bus)

Moreover MRK960 system is already set up for the exclusive **PTT function** (remote command), developed and patented by Wisycom and now appreciated in the broadcast world:

> *Simply pushing this button (PTT), the presenter causes the remote switching of the receiver's output-line, from the "main line" to the additional "intercom line", in order to be able to talk "off-air" directly with the technical team. Then all PTT's MICs can be connected in pre-fading allowing a clever intercom setup.*

Safety instruction

- Read this safety instruction and the manual first.
- Follow all instructions and information.
- Do not loose this manual.
- Do not use this apparatus under the rain or near the water.
- **ATTENTION**: supply the apparatus with a correct mains voltage and with the ground connection. Check the power cord integrity.
- The power cord must be protected from damage.
- Do not install the apparatus near heaters or in hot environments, do not use outside the operating temperature range.
- Mount the apparatus as indicated in the instruction, do not block side grids for air ventilation.
- If the external air filter is mounted, clean it regularly.

- **WARNING**: do not open the apparatus, **RISK OF ELECTRIC SHOCK!**
- Do not open the apparatus, only qualified service technician are enabled to operate on it. The apparatus needs servicing when is not properly working or is damaged by liquids, moisture or other objects are fallen in the apparatus.
- Use only accessories or replacement parts authorized or specified from the manufacturer.
- Do not supply more than 7 apparatus MRK960 from the mains output, see power requirements for other apparatus.
- Clean the apparatus only with dry cloths, do not use liquids.
- The ON/OFF is a double pole circuit breaker, but to ensure the complete disconnection of the apparatus, disconnect the power cord.
- Report the serial number and the purchasing date in front of the manual, it is needed to have proper replacement parts or accessories from the manufacturer.
- When replacement parts are needed, use only replacement parts authorized from the manufacturer. Substitution with not authorized parts could result in electric shock, hazards or fire.
  - » Keep attention on all the labels with warnings or hazards on the apparatus.
- **WARNING**: The apparatus is intended for professional use; anyway the manufacturer alerts the user that the headphone output power of the apparatus could exceed the level of 85 dB(A) of sound pressure level and this could be dangerous for the hearings. Do not use the headphone with high power level or for long time. Reduce the power or suspend the hearing in the case of any kind of hearing problem.

Main features

MRK 960 is a modular wireless-microphone receiver System in a 19” 1 unit module, stackable, with dual true diversity receivers:

- Extreme RF (radiofrequency) performances and reliability.
- Tuning windows of 240 MHz with tunables filters (2 ch’s independent): **470/840 MHz (TV ch 21/67) with internal active splitter**
- Wisycom digital expansion bus (DEXB) for future upgrade/enhancement thru simple slot-in card (pc-like). DEXB can host DSP (40bit dsp processing) upgrade cards providing:
- digital output (i.e. AES3, Ethersound)
- multi-companding compatibility
- future digital functionality enhancements.
- Balanced electronic AF output (low impedance transformer-coupled optional)
- 2 USB’s connectors for configuration/monitor and cascade rack connections
- Automatic scan for best channels, squelch and other automatic setup
- Infrared interface (i.e. for system setup, microphone programming)
- Automatic transmitter re-programming (thru infrared, sync function)

- Software to monitor/setup units and with spectrum field analysis
- Ethernet 10/100 base Tx network interface for configuration/monitor
- Digital audio interfaces: AES/EBU (with word-clock in/out)

Optional:

- Ethersound® interface
- Push to Talk (PTT) function with audio exit and GPI signals (patented)
- Very low impedance transformer outputs

TECHNICAL DESCRIPTION

The MRK960 is a professional dual diversity receiver for wireless microphones reception especially designed for broadcast production, live stages, theatres and top professional applications.

It's winning performances are:

- **High immunity on strong rf environment**
- **Huge switching bandwidth**
- **High audio performances and flexibility thanks to the digital processors**
- **High reliability and durability**

One of the milestones in the design of the MRK960 is high reliability: most of the circuitry of the receiver is independent one from each other.

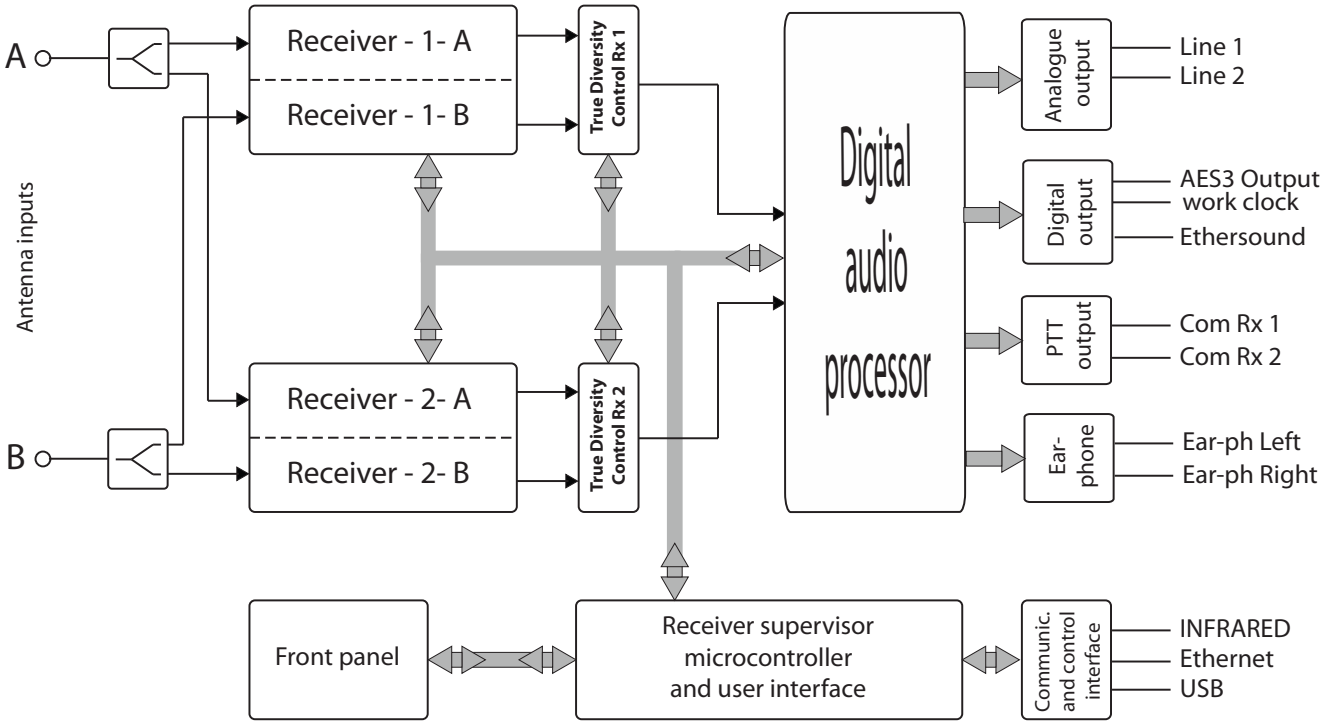
Here below a schematic with an overview of main receiver functions.

Starting from the antenna inputs, each antenna could be indipendently powered from a single power regulator monitored from the microcontroller.

For each antenna the RF signal is splitted in the receiver 1 and in the receiver 2 (antenna A and antenna B) with a wide band splitter. In this way any one receiver could be tuned in any frequency of the switching range (370 MHz).

Receiver 1 and 2 are true diversity receivers: each one is made of two receivers tuned on the same frequency, hereafter called section A and section B. The receiver 1 section A and the receiver 2 section A are connected to the antenna A, the receiver 1 section B and the receiver 2 section B are connected at the antenna B.

Each receiver has its own demodulated signal and its own RSSI signal (Receiver Signal Strenght Indication); a microcontroller select or combine signals from section A & B to have the best audio. The demodulated signal flows to the digital audio processor.



MRK960: main block diagram

The data sub carrier is digitally filtered to a very selective equivalent filter (bandwidth 3Hz). Each filter has its own data demodulator, one for medium speed data detection at the output of the first filter and one at low speed data detection at the output of the second filter. All the two demodulators are connected to the supervisor micro controller for the data battery detection and signalling.

Digital audio processor(for each receiver): the demodulated signal is filtered by an anti aliasing low pass filter and then converted in the digital domain with a 96KHz 24bit audio A/D converter. The digital signal processor (DSP), working in double precision, replicates all the analog functions with very high accuracy, ultra low distortion and without typical analog problems like components tolerances or long term or temperature drifts etc. The high speed audio algorithms maintains the audio delay at about 0.390 milliseconds, making it ideally for live events and to keep audio delay as short as possible. The DSP unit also filters and demodulates the data carrier and communicates all the parameters and informations to the supervisor micro controller. The audio output goes to the digital outputs (AES3) or is converted in the analog domain with a high quality 24 bits 96KHz D/A converter and an anti-aliasing filter.

The analogue audio signal is routed in three parallel ways, ***LINE***, ***COM*** and ***HEADPHONE MONITOR*** amplifier. The *HEADPHONE MONITOR* amplifier is controlled by the buttons on the front panel and by the volume knob. The monitor output depends on the squelch and on the tone squelch only in the TSQ ON selection. In TSQ OFF and in TSQ ADV the monitor output is muted only by the squelch control.

The two analogue audio ways, *LINE* and *COM*, has the same audio quality and are controlledy by the “Tone squelch matrix”. Each audio driver has a VCA for the soft switching of the audio signal and the muting functions, controlled by the supervisor microcontroller. After the VCA, an electronically balanced amplifier drives the output signal, directly or thru a very low impedance screened audio transformer (optional). The audio output without transformer could withstand up to +52 Vdc of phantom supply with no damage and up to 100V with transformer.

USER GUIDE

Front panel functions

MRK960 allows an easy and quick configuration using buttons, push knobs and displays.

The front panel is functionally divided in the following section:

A **Scan & Squelch**: automatic scan and squelch settings;

B **Infrared**: remote controlling and MIC setup through infrared interface.

C **Receiver 1**: “receiver 1” configuration and monitor of radio/deviation levels.

D **Receiver 2**: “receiver 2” configuration and monitor of radio/deviation levels.

E **Monitor**: monitoring audio output on headphone jack (6.3mm - ¼”).

Power & Booster: powering ON or OFF the receiver and the antenna boosters

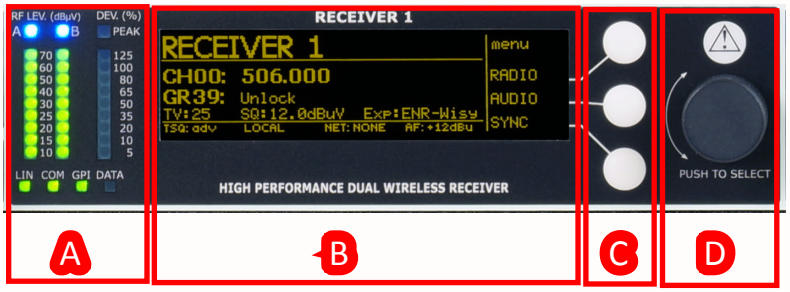
SCAN & SQUELCH & INFRARED

The function **SCAN** initiates an automatic procedure for the choice of the less noisy channel in the selected group of channels; the scan function measures the floor noise of all the channels of the selected group and show the result in the display. This is a quick way to find the best channels to use in the selected group. When pushed the scan button, it is needed to setup or confirm the group of channels for the scan.

SQUELCH initiates the automatic procedure to setup the level of the squelch. This is an automatic way to quick setup the squelch for the current frequency. The transmitter must be off, then push SQ button to let the system find the optimal value. You can later accept, modify or discharge this setup.

IR interface window: for communications between the MRK950 and a transmitter. You have to put the IR interface of the transmitter, with the IR interface active, in front of this window. This is needed for example in the SYNC function.

RECEIVER 1 and RECEIVER 2



Area A: 3 LED bars:

- two bars for the RF levels in dBuVolt (diversity A & B antenna level),
- FM modulation of the received channel (modulation in % referred to the nominal deviation)
- LIN: audio in line output active
- COM: audio in com output active (optional)
- GPI: g.p.i. command thru opto-isolated relay, active (optional)
- DATA: data subcarrier from microphone transmitter detected

Area B: display (256 x 64 pixels yellow OLED display)

Area C: 3 push buttons (membrane).
The function of each button (upper, middle and lower) will be readable from the context menu on the display.

Area D: Push rotary knob and light indicator

Warning (YELLOW) and Alarm (RED) light indicator:

- **Yellow Fixed** light indicator (Warning) when there is no audio in both the audio outputs (COM and LINE)
- **Red Slow Blinking** light indicator (Low Alarm) when the battery level of the transmitter is ≤25%
- **Red Fast Blinking** light indicator (Medium Alarm) when the battery level of the transmitter is ≤12%
- **Red Fixed light indicator** (High Alarm) when a booster (A or B) has a short circuit. Moreover the following message appears on the OLED display: "Over Current on antenna A/B"

MONITOR

Monitor 1 and 2:it activates monitor audio on jack output (6.3mm - ¼") for receiver 1 and 2, respectively (a green LED is lighted when audio is enable). Audio level can be adjusted with the rotary knob. The red led (CLIP) indicates a clipping in the audio monitor output.

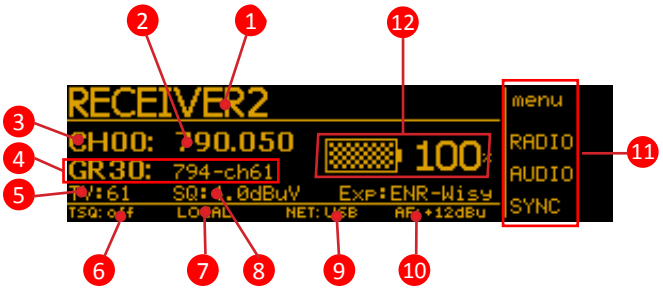
POWER & BOOSTER

BOOSTER:it activates antenna powering (boosters) with 12VDC (200mA max) and the green LED is lighted. Blinking LED indicates a faulty condition, in this case power down the device and check for short circuits or overloads in the RF cables or boosters.
Booster supply for antenna A and antenna B are indipendent, switchable from the RADIO > OPTIONS menu.

POWER: ON/OFF square powering button turns on/off the receiver. When in OFF position both phases are disconnected from power.

LCD display: Main view

All the basic information on the receiver status are readable in the main view of the LCD display.
The main view has the following info:

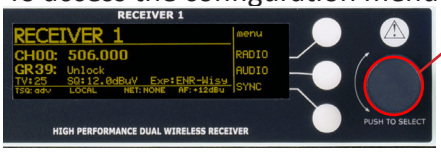


1. receiver name,
2. current tuning frequency
3. current channel number
4. current group number and group name
5. TV channel used for the current frequency
6. Tone Squelch current setup
7. LOCAL or REMOTE receiver management, via USB or Ethernet connection
8. Squelch level (microVolt)
9. NET connection to a host PC (USB or Ethernet)
10. Analog audio output level at nominal FM deviation
11. status of the output lines (audio line, audio com, gpi) and detection of the digital data carrier (i.e. transmitter battery data carrier or tone squelch),
12. transmitter battery charge status.

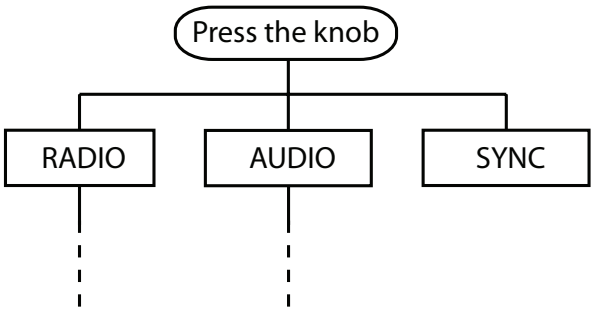
Thru the main menu on the LCD display and the LED bars for the RF level and modulation the user has the complete monitoring in real time of the wireless channel in use.

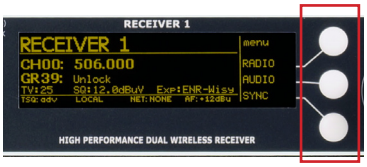
Menu tree

To access the configuration menu of the receiver is necessary to press the rotary knob (at the right of the display). This allows you to access the main menu.



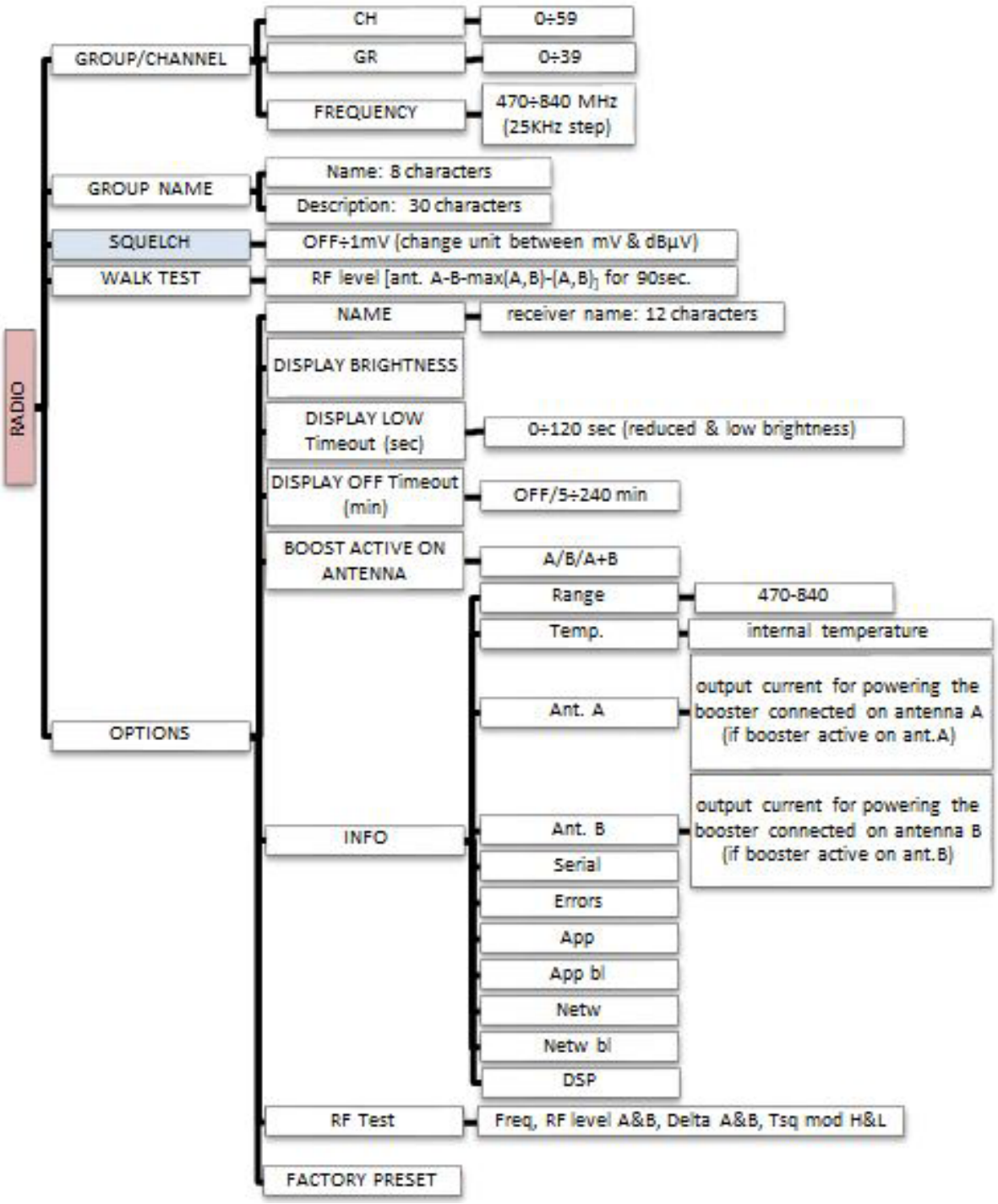
Pressing firt the rotary know shows a hidden window (area 11 the image of the main view) with three main headings: “**RADIO**”, “**AUDIO**”, “**SYNC**“.
To activate one of the items in the menu, press the corresponding button to the right of the display (see picture hereafter).





Radio menu

The first item on the menu tree is “RADIO”. Pressing the upper button (RADIO), you go at the RF functions menu of the receiver, as shown below:



Chan-Group

The **CHANNEL-GROUP** item enables the user to edit channel, channel group and frequency of the selected items. Change, rotating the knob, the channel or the group of channels and confirm or exit with the buttons. To edit the frequency of selected channel, press the middle button and change it with the knob. Press the knob to move between MHz and KHz. Confirm or exit with the buttons.

As shown in the above picture, the display area has 3 rows with:

1] Channel number (0 to 60) and Channel frequency (in 25kHz step)
2] Group number (1 to 40) and group name (8 char.)
3] Group description (30 char.)

The MRK960 has 40 groups of 60 channels each. Normally this is too much for wireless microphones applications.

Connecting with computer with WISYCOM MANAGER software, it is possible to hide single channels or even complete groups of channels: once hidden those items are not shown anymore on the channels or groups selection. To show channels or groups hidden use again the WISYCOM MANAGER software.

Using this software it is also possible to lock channels or groups. When a channel is locked, it is not possible to change the frequency from the front panel of the receiver. Locking a group means that all channels are locked. When a channel or a group are locked, at the left of the group name in the Chan-Group menu will appear a lock icon as shown in the picture below. When the lock picture is shown, the central button is not displayed, thus changing frequency is not possible.

Gr. name

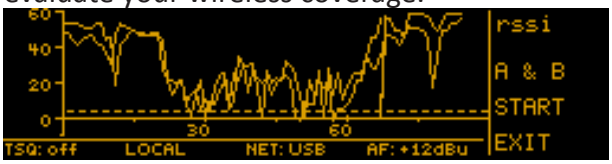
The second item on the radio menu is **GROUP NAME**; with this function is possible to assign or change a name to a group of channel. This short name (8 character) is displayed at the right of the group number in the main display view. First chose the the group and then press the knob. You will be able to edit any character of the group name rotating the knob. Push the knob to edit the next character. Confirm or exit with the buttons.

Squelch

The **SQUELCH** function allows to assign a value at the squelch of the receiver. Rotating the knob it is possible to change current squelch level from OFF (it means no audio squelch) to 1mV. Pressing the knob you could setup the desired level and also configure you measurement unit between microVolts and dBµV. At the end confirm or exit with the buttons. There is also an automatic procedure to set up the squelch level, it will be discussed later in this document at the ***Autoset SQUELCH*** item.

Walk test

The **WALK TEST** function records the RF level of the two antenna inputs, separately, for a total time of 90 seconds. Using the first button, it is possible to choose what to plot: the rf level of the antenna A or B, the Max value between antenna A and B or both antenna levels separately. Press START and walk on your area with a wirelss MIC (transmitting at the current frequency) while receiver records all received RF levels. At the end of the sweep time it is possible to have a look on the graph and check if there are some "hole of RF signals" and evaluate your wireless coverage.



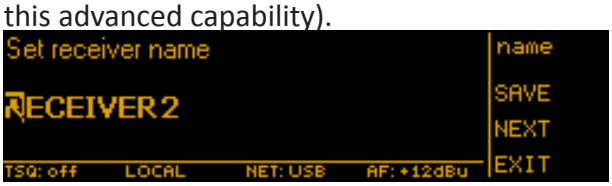
Finally push the 3rd button (EXIT) to leave this fucntion. As "rule of the thumb", the signal coverage of the stage could be considered good if, in all the stage, ***the signal "MAX AB" is never lower than 10µV or 20dBµV***. The plot in the picture, shows a very low coverage with some areas not covered by the two receiving antennas. In this case probably the position of the antennas must be changed and/or the gain of the boosters adjusted.

Note: the unit for RF level is the same chosen for the squelch level (*dBuVolt* or *uVolt*)

OPTIONS:

Name

The options **NAME** allow you to change the name of the receiver. This is the name displayed in the top of the display in the main view and is the name sent to the transmitter with the sync function (for transmitters with this advanced capability).



Use the knob to change the name and the buttons to save or exit from the function (12 alphanumeric characters: A-Za-z0-9, case-sensitive).

Display Brightness and Timeout

Display brightness allows to change the brightness of the display from 1 to 15 level (step 1 dB).
Display LOW Timeout [0÷120 sec] controls display behaviour as follow:
- After a first timer timeout without any input on the receiver (buttons or wheel) the display gost on "REDUCED BRIGHTNESS MODE"
- After another timer timeout, the receiver goes into "LOW BRIGHTNESS MODE", and leaves current menu to be back on TOP MENU.

Display OFF Timeout: [OFF, 5÷240 min] after the timeout without any input on the receiver (buttons or wheel) the display switches off. (OFF=display always power on.)
NOTE: Each receiver has indipendent display parameters.

Boost active on antenna

allows to select which antenna input (A, B or A+B) has to be powered on by pressing BOOSTER button from the front panel.

Info

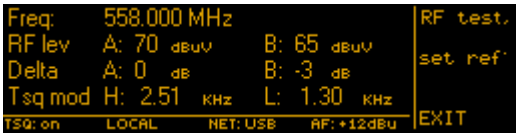
the **INFO** function shows many important features or information of your MRK960 receiver:

- Range: info about the frequency limits of the receiver.
- Temp: internal temperature of MRK960.
- Ant. A and Ant. B: the measure of the output current for powering the boosters connected on antenna input A e B connectors. The current measurement is active only when boosters are switched on. The booster supply voltage is 12 Volts.
- Serial: serial number of the MRK960 receiver.
- Errors: number of internal errors detected by the receiver, useful for service or maintenance.
- App: release version of the main application firmware.
- App bl: release version of the main application firmware updater (bootloader).
- Netw: release version of the network communication firmware.
- Netw bl: release version of the network communication firmware updater (bootloader).
- DSP: release version of the DSP firmware.

Note: the complete software and hardware status is displayed switching ON the receiver with a knob pressed. Press this knob a second time to exit this function.

RF test

This menu gives some information of the RF signal measured.



Note: low level of Tsq. mod means that the Tone squelch is not detected from the receiver

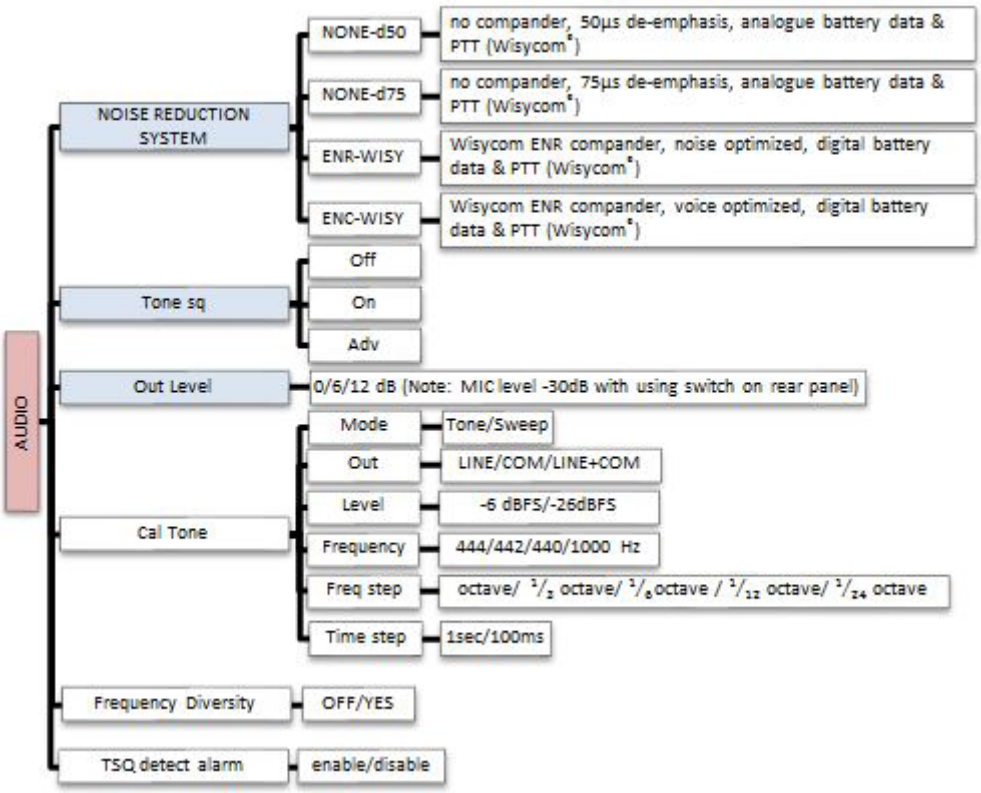
Factory preset

The **FACTORY PRESET** resets the following setups to factory defaults: tone squelch (OFF), noise reduction system (ENR), audio output level (12dBu), cal tone (OFF), audio matrix, booster supply (OFF) and headphone selection (OFF).

Note: receiver names, frequencies, groups or channels information are NOT changed.

Audio menu

The second item on the menu tree is "**AUDIO**".



Noise Red

The **NOISE REDUCTION SYSTEM** is used to select your current noise reduction system in the audio path. Thanks to the DSP board, it is possible to choose different types of audio processors. MRK960 supports, as standard configuration, the following type of "Companding system":

NONE-d50 NO compander, 50µs de-emphasis
Analogue battery data & PTT (Wisycom®)

NONE-d75 NO compander, 75µs de-emphasis
Analogue battery data & PTT (Wisycom®)

ENR-WISY Wisycom ENR compander, noise optimized
Digital battery data & Ptt (Wisycom®)

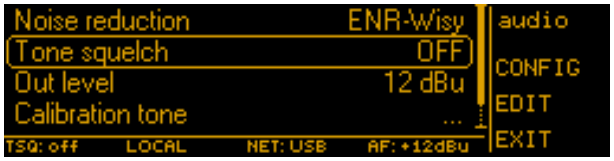
ENC-WISY Wisycom ENC compander, voice and high-fidelity optimized
Digital battery data & Ptt (Wisycom®)

Use the buttons to save or exit from this function. Depending on selected NOISE REDUCTION SYSTEM, tone squelch function and transmitter battery status could be enabled or disabled (since not all the wireless microphones have this enhanced functionality).

Tone sq.

The **TONE SQUELCH** function is an advanced function (whose behaviour depends on selected noise reduction system). This chapter explains TONE SQUELCH operations when associated to a Wisycom wireless microphone with the ENR-WISY or ENC-WISY as active noise reduction system. Other types of wireless microphones could have different behaviour or could not work properly. Here-after the complete tone squelch function, whenever the receiver does not have all the options installed, some functions will be hidden.

The tone squelch selection could be OFF, ON or ADV (advanced). After the SAVE of tone squelch selected, a CONFIG submenu appears on the right. Enter on the CONFIG submenu to change the setting of the choosen



Tone Squelch (see matrix below). With the knob and the buttons, it is possible to choose, for any one of the three TSQ modes, the status of the audio outputs LINE and COM and in the TSQ ADV mode it is possible to choose the status of outputs LINE, COM and GPI, when the transmitter PTT button is released or pushed. The dot in the circle on the left of the display shows the actual setting for the tone squelch function.

Tone squelch OFF enables the audio output on LINE and COM (if present) connectors always, it could be muted only by the squelch on RF signal (the RF squelch has always priority).

Tone squelch ON enables the audio output on LINE and COM (if present) only if the transmitter sends the correct identification tone signal (tone squelch).

Tone squelch ADV (with or without PTT options), on microphone transmitters, gives more possibilities of audio routing and GPI signalling.

Note: the tone squelch could not substitute the squelch on the RF signal level. For the best performance of the receiver it is better to use the SQUELCH & TONE SQUELCH together.

Out level

The **OUT LEVEL** function allows the adjustment of the audio level on the LINE and COM balanced outputs. The nominal level, used also in the technical specifications of the receiver, is 12dBu at nominal modulation and could reach 18dBu to 20dBu in clipping. This level could be too high for some audio mixing units, so with the out level function it is possible to reduce the nominal level from 12dBu to 6dBu or 0dBu. This setting is unique for LINE and COM.

Note: the audio output level could be further reduced by 30dB with a switch below the XLR output connector, in the rear panel.

Cal. tone

The **CALIBRATION TONE** function generates a tone (at specific frequecies) or a sweep of tones at the audio outputs. Change the value of the following parameters according to the desiderable calibration tone:

- Mode: select the type of calibration tone (Tone/Sweep)
- Out: select the outputs for the calibration tone (only LINE, only COM or LINE and COM together)
- Level: select the level (-6 dBFS or -26 dBFS)
- Frequency (only for Tone): 444/442/440/1000Hz
- Freq step (only for Sweep): ocatve ÷ 1/24 octave
- Time step (only for Sweep): 1sec/100ms

With the buttons it is possible to start, stop and exit from the tone generation. The output not selected for the tone generation will be muted.
When the tone is active at least in one output, the led bar of the deviation indicates the level selected.

Frequency diversity

This option is normally set to OFF. Set to YES when you need:

- to increase the reliability in case of failure
- to increase the reliability in case of transmitter batteries empty
- to increase the security against fading due to reflections on the radio link

When a receiver is set to frequency diversity YES, the audio output is calculated from the best RF signal received from the two receivers.

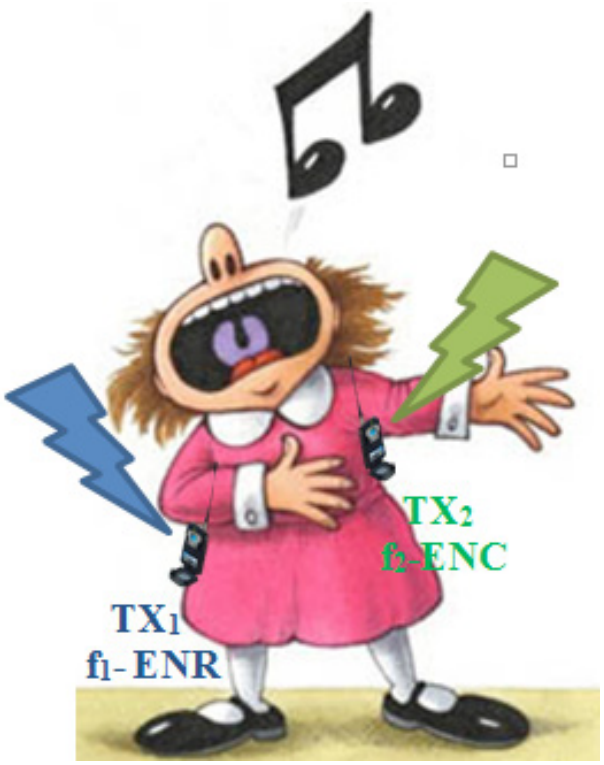
WARNING: two transmitters tuned with the two receivers must be placed on the same audio source and must have the same configuration (ex. gain, tone squelch setting, RF power, distance from the audio source….). NOTE: the Noise reduction can be different.

Note: Frequency diversity in each receiver can be set independently.

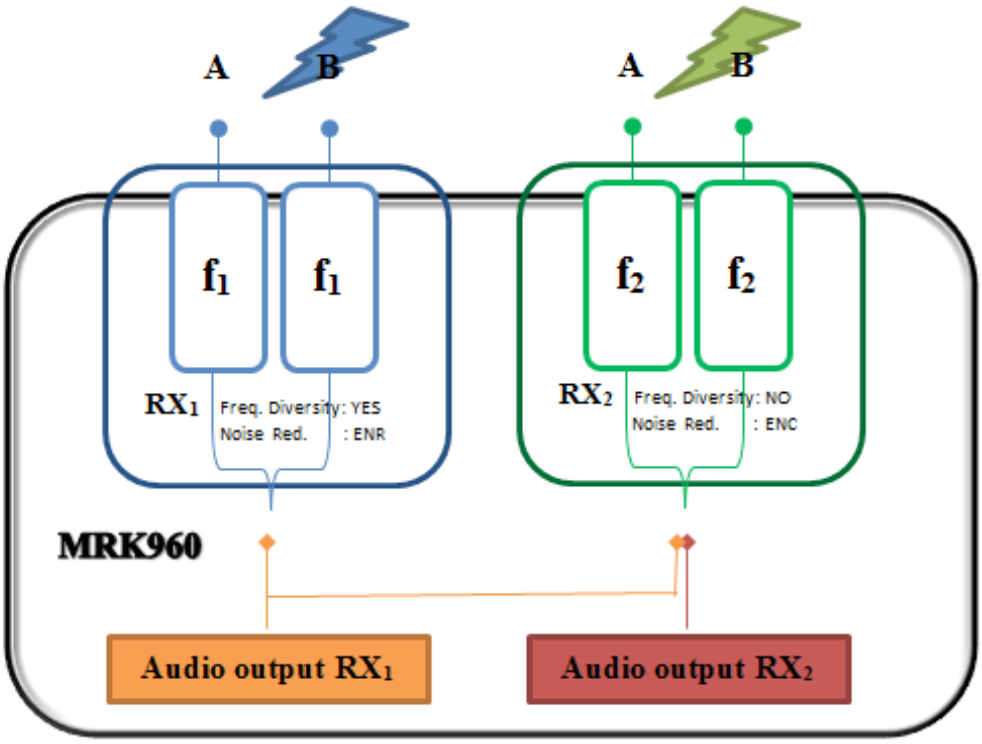
Note: With frequency diversity enabled (set to YES), the Tone Squelch menu allows only the setting options ON and OFF (the ADV option is not allowed).

Frequency diversity example:

RX1 tuned on f1 with Frequency Diversity set to YES.
RX2 tuned on f2 with Frequency Diversity set to NO.



Audio output RX1 is calculated from the best RF signal received from the two receivers.
Audio output RX2 is calculated from the RF signal received from RX2.



TSQ detect alarm

This option is normally disabled.
If enabled, the receiver shows an alarm “Tone squelch not detected” in case of absence of tone squelch. The alarm appears when the audio output becomes suddenly muted in the following conditions:

- “AUDIO>Tone sq” set to ON or ADV
- RF level > squelch
- Tone squelch not detected

Sync

The **SYNC** function, selected from the main menu with the lower button, is useful to tune a transmitter on the same frequency of the receiver via the IR interface. Before starting the sync function tune the receiver on desired channel, manually or using the SCAN utility. After this, enable the IR interface on the transmitter. Now press the knob and the lower button to start the SYNC function. Keep the IR window of the transmitter in front of the IR window of the receiver and, as soon as the connection is done, the receiver will send to the transmitter all the information needed. If the operation is not possible, (i.e. the frequency range of the transmitter is not compatible with the frequency of the receiver), the display will show an error message. If the transmitter has the function “NAME” enabled, when the sync function is completed it will show the same name of the syncronized receiver.

SQ (squelch autoset)

The **SQUELCH AUTOSET** function helps the user to set the squelch level of the receiver at a good level for the selected channel.

After pressing the SQ autoset button, the two receivers ask to switch off the transmitter and then, after the user confirmation (on one receiver or all the two receivers at the same time), it starts to measure the noise in the selected channel.

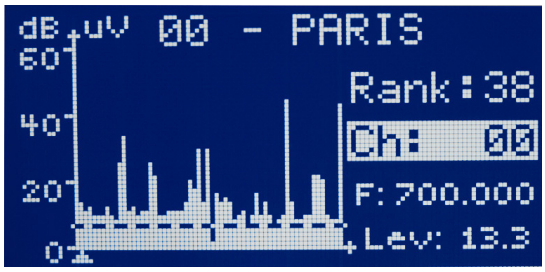
A few time later, after some calculation, the receiver proposes the new squelch level.

The user could then accept, refuse or modify it by means of the buttons and of the knob.

Note: during the Autoset SQUELCH function it is not possible to change the unit of the squelch voltage.

SCAN

The SCAN function is very useful to discover the best channels to use (the channels with lower RF noise) in the selected group. After pressing the SCAN button, both receivers are ready to start with the SCAN function. It is possible to select the receiver 1 or the receiver 2 or both (i.e. simultaneously scan on different groups).
With the first menu on the display it is possible to choose the group of channels for the scan and, pressing the knob, is possible to define a reference line drawing in the final scan result graphic, just for user reference. Pressing the knob the focus change between REF LINE and GROUP.
Pressing the START button, an alert window remind the user to switch off all the transmitters before starting the SCAN, press START again and the SCAN function will start. At the end of the analisys, on the display it is possible to see the graph of the RF levels measured in each channel and, rotating the knob, it is possible to move the marker on the bottom of the graph just to see the channel number and the RF level measured for that channel.
Pressing the knob it is possible to have a graph in rank order instead of channels order, so, it is very simple in rank order to find the less noisy channels because they are in the left part of the graph.
The marker is always active rotating the knob.
Pressing the knob the graph changes between rank order to channel order again.
For terminating the SCAN function, press the lower button on the right of the display.



In the above picture a typical graph of the scan function (only the graph area of the display). This graph, ordered by channel numbers, shows the RF levels in dBµV for each channel in the selected group (i.e. Ch: 00). Rotating the knob the small arrow cursor moves from a channel to the next one; on the right of the graph it is possible to see the rank of the channel selected by the cursor, its number, its frequency and the RF level. Pressing the knob the order of the graph became the rank, not the channel number. In this way it is more simple to choose channels with lower RF noise, they are in the left part of the graph. See at the picture below:

In this graph the channels are ordered by rank. Turning the knob it is possible to change the channel and reading its number, frequency and level of RF noise.

The horizontal dashed line is the squelch level set before starting the scan.

Connecting an headphone at the monitor output, is possible to ear the signal in the channel selected by the knob. If the RF signal is below the squelch level, the upper button near the display disable/enable the squelch so the audio output is enabled also for weak RF signal.

The SELECT button is the exit from the SCAN function tuning the receiver on the selected channel, the EXIT button exits from the SCAN function leaving the receiver channel unchanged.

OPERATING INFORMATIONS

RF Level led bars

Two RF level led bars for each receiver indicate measured RF level at the antenna input of the receiver in the selected channel. For a typical diversity reception it is a good starting point to consider that the two signals should have the same average level over time, but this could be different while moving the transmitter on the stage. The important issue is that moving the transmitter on the stage, the diversity has to work switching from one receiver to the other receiver as indicated by the two blue leds on the top of the bars. When the RF levels of the two inputs have similar level, the diversity control enable the two receiver at the same time, further increasing the S/N ratio at the audio output.

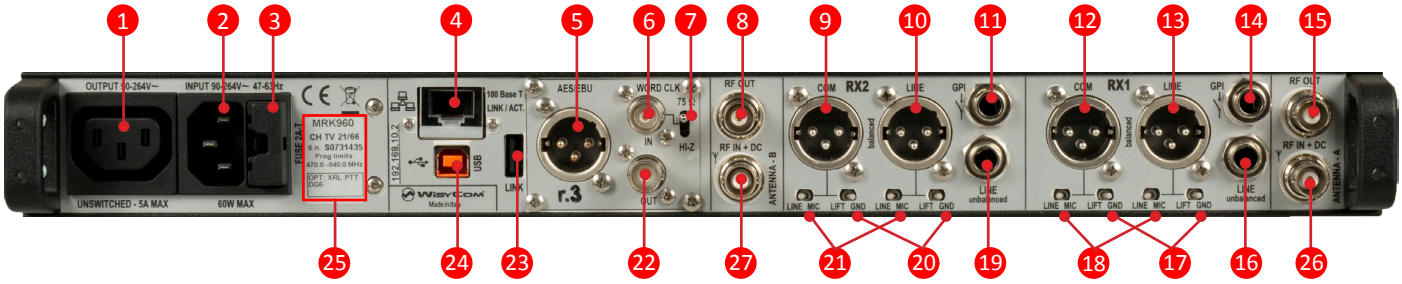
Modulation led bar

The third led bar of each receiver indicates current channel modulation as percentage of nominal deviation (not the audio output level). The difference between modulation and audio level is because normally there is a preemphasis on audio transmission and some manufacturer uses different compression values and different audio frequency equalization. Therefore to have the maximun efficiency of the radio channel it is important to use the highest modulation bandwidth possible, in respect to the dynamic range of the audio signal and the manufacturer specifications. If the receiver MRK950 has the DSP board option, the scale of the modulation will be changed according to the nominal modulation of the type of microphone and manufacturer selected in the NOISE REDUCTION SYSTEM. The modulation led bar is blank when the squelch and/or the tone squelch opens the audio output circuit (or if there is no modulation on the transmitter, of course). Adjust the gain of the audio chain in the transmitter to have in the maximum modulation peaks the 100% of modulation bandwidth, leaving the next 6dB of modulation margin before clipping (red PEAK led) for extra sound pressure margin. If the audio level is not exactly known, be conservative and adjust the microphone gain in a lower position to avoid clippings during the working session.

Battery indication

On the main display of each receiver is always well visible the battery status of the transmitter (area 12 of the main view). The resolution of the indication depends on the transmitter. Wisycom transmitters send 8 levels of battery charge status, other competitors 6 or 4 or 3 level (full, half, empty).
When the transmitter is a Wisycom, the display of the batteries indicate the correct icon and the percentage of the charge but, when the charge reach the 25% the battery area on the display became flashing, when the charge reach the ***12,5%***, the illumination of the display is ***flashing to give an high visibility alarm*** to the user.

Rear panel

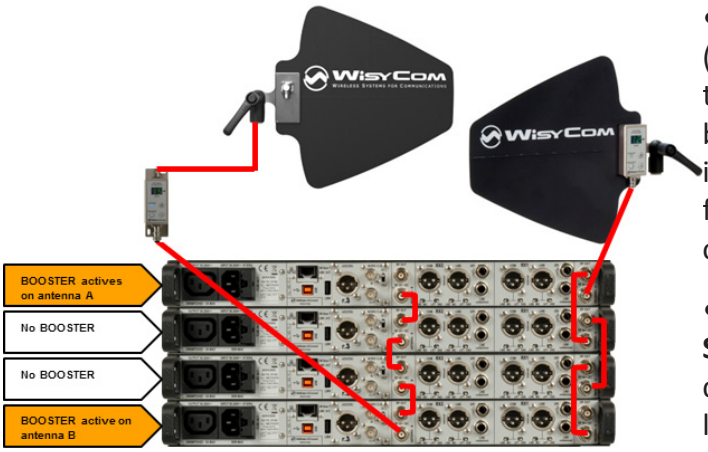


1. Mains output. Do not connect more than 8 units.
2. Mains socket input.
3. Mains fuse (2A-T).
4. Ethernet connector RJ45 for LAN connection of the receiver. The leds on the connectore indicate the status of the connection (Link and Activity).
5. AES/EBU XLR 3 pin output connector, digital audio output transformer isolated, balanced. This is part of the AES/EBU optional board, toghether with 6, 7 and 22. Here it is possible to install different option like Ethersound© I/O. (Optional)
6. Word clock input for external syncronization of digital audio output.
7. 75 ohms termination switch for word clock input.
8. Antenna B input, BNC connector, DC output for booster power supply.
9. XLR 3 pin male connector, COM audio output of the receiver 2, balanced. *(Optional)*
10. XLR 3 pin male connector, LINE audio output of the receiver 2, balanced.
11. GPI output of the receiver 2, 1/4” (6,3mm) stereo jack socket. *(Optional)*
12. XLR 3 pin male connector, COM audio output of the receiver 1, balanced. *(Optional)*
13. XLR 3 pin male connector, LINE audio output of the receiver 1, balanced.
14. GPI output of the receiver 1, 1/4” (6,3mm) stereo jack socket. *(Optional)*
15. Antenna A input, BNC connector, DC output for booster power supply.
16. Unbalanced LINE audio output of receiver 1, 1/4” (6,3mm) stereo jack socket.
17. Switches for shorting the pin 1 of the XLR connectors of receiver 1 to the receiver ground or not.
18. Switches for attenuating the audio output level on the XLR connectors. The attenuation is 30dB.
19. Unbalanced LINE audio output of receiver 2, 1/4” (6,3mm) stereo jack socket.
20. Switches for shorting the pin 1 of the XLR connectors of receiver 2 to the receiver ground or not.
21. Switches for attenuating the audio output level on the XLR connectors. The attenuation is 30dB.
22. Word clock output, for daisy chain connection. BNC connector. *(Optional)*
23. LINK connection, for cascade connection of receivers, for remote control functionality. USB-A connector.
24. USB-B connector for PC connection if this MRK960 is a subnet controller. If this MRK960 is part of a subnet, this connector must be connected to the LINK connector of the previous MRK960.
25. Product identification label.
26. Antenna A output, BNC connector (for antenna splitting)
27. Antenna B output, BNC connector (for antenna slipping)

RECEIVER CONNECTION

Antenna Connection

The MRK960 has two antenna inputs, necessary for a true diversity reception system. Each input signal is splitted for the two diversity receivers on the MRK960. Each antenna input could deliver a booster supply of 200mA at 12Vdc; this is enough to supply an active antenna like the Wisycom LBNA and a booster like the Wisycom BAA, needed only when the antenna cable has a very high attenuation.
For connecting more receivers on same antennas use



• the **antennas cascade configuration** as in the picture (typ. 8 receivers). Connect the output antenna connector to the input of the next receiver. in reverse order between antennas side A and antennas side B. Using this configuration in case of one of the receiver is faulty, the other receivers can continue to work (without diversity).

• active wideband antenna splitters like the Wisycom **SPL214AW** for four MRK960 (8 wireless microphone channels) or the **SPL218AW** for eight MRK960 (16 wireless microphone channels). More channels are possible combining more splitters. In this case the active antennas and the boosters will be powered by the splitters.

Analog audio connection

The MRK960, in the full optional audio output configuration, has three audio outputs for each receiver, two balanced with XLR connector and one unbalanced with a 1/4" (6.3 mm) stereo jack connector. The unbalanced audio output has the same audio signal of the LINE output. The balanced audio outputs could be electronically balanced or transformer isolated with very low impedance when the **TRAFO option** is installed.
Below the XLR connectors there are two switches:

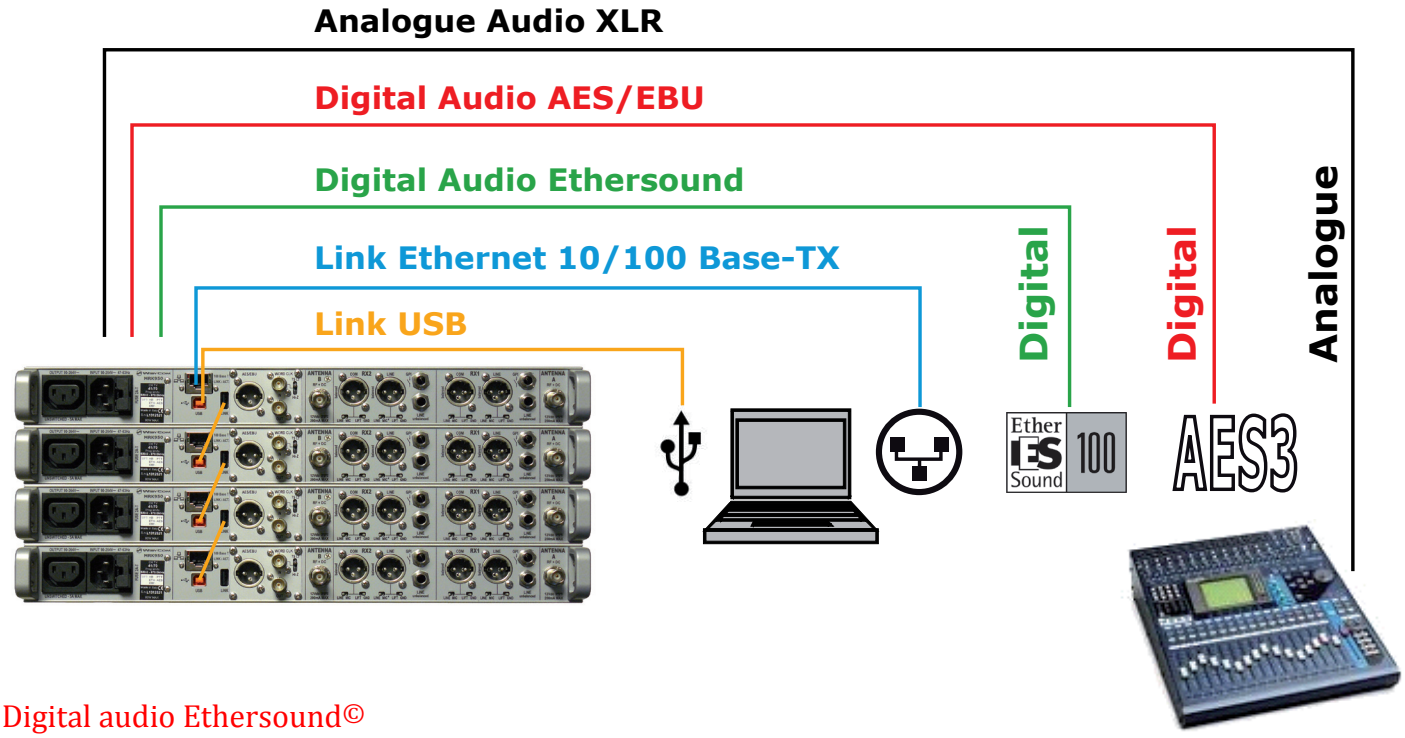
» the left one (LINE/MIC) inserts a fixed resistive attenuator of 30dB on the audio output; the audio levels on the XLR connector, according to the setting of the "**Out level**" and to the setting of the switch below the XLR connectors, at nominal modulation, are:

	Out lev 12dBu	*Out lev 6 dBu*	*Out lev 0 dBu*
Att. 0dB	**12 dBu**	**6 dBu**	**0 dBu**
Att.30dB	**-18 dBu**	**-24 dBu**	**-30 dBu**

» the switch on the right (LIFT/) cuts the connection beetween the pin one of the XLR connector and the ground of the MRK960 to avoid ground loops.

Digital audio AES/EBU

The MRK960 has an digital audio output channel according to the AES3 or AES/EBU standards for professional 24 bit digital audio. The left channel of the AES3 stream is the audio of the receiver 1 and the right channel is the audio of the receiver 2. When no word clock is connected, the sampling rate of the digital audio output is fixed at 48KHz, internally crystal generated; with the external word clock the sampling rate could be from 32KHz to 108KHz. The word clock input could be left at high impedance or loaded to 75 ohms. The word clock output could be connected to the next MRK960 or could be left open.



Digital audio Ethersound©

The Ethersound option on the MRK960 adds the capability of a connection beetween the MRK960 and an Ethersound audio distribution system. This option adds two RJ45 connectors for the ethernet cables, one is the input and the other is the output of the Ethersound interface.

Link Ethernet 10/100 Mbit/s

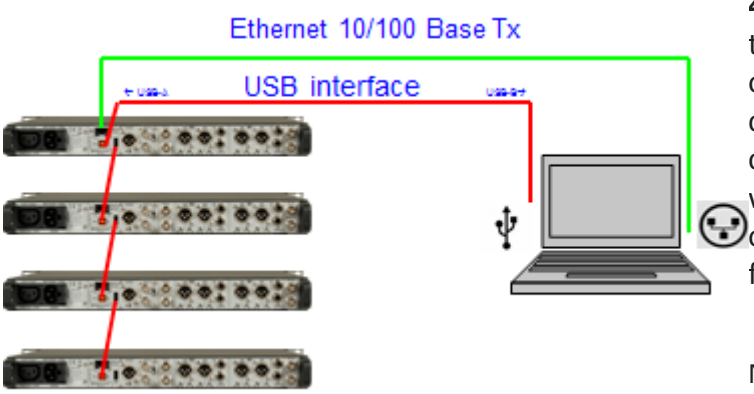
The Ethernet interface is used to connect an MRK960 to an host PC for remote monitoring. The “WISYCOM MANAGER” is the PC software for the complete remote monitoring and managing several MRK960 also connected thru an USB cascade.
WISYCOM MANAGER is able to find a configure network parameter of a MRK960 in ethernet connection without knowing its IP address (this is done thru a broadcast discovery). Near the ethernet connector there are two led lamps, one for the connection check and one for the data monitoring.
A receiver connected to a PC could be an subnet controller for other receivers if the other receivers are connected in a chain with USB cables as shown on the picture “4 rack USB CASCADE”.

USB connection

The MRK960 comes with an USB 1.1 interface that has priority over ethernet connection (in case of USB port connected to a PC, the ethernet port is disable). Near the USB connector there is another connector named LINK. This connector could be connected to the USB port of the next MRK960 with an USB-A to USB-B cable to build a chain of receivers. The maximum number of receivers in a chain is four. The receiver with the USB connector free is the subnet controller receiver (the one in the upper position on the picture). It must be connected to a PC by means of the USB port or by means of an ethernet connection. Once connected, start the WISYCOM MANAGER software to manage the array of receivers (more details on software manual).

NETWORK CONNECTION

Wisycom Manager software allows to monitor and configure remotely complex systems base on MRK960s connected in USB chain or thru ethernet connection.

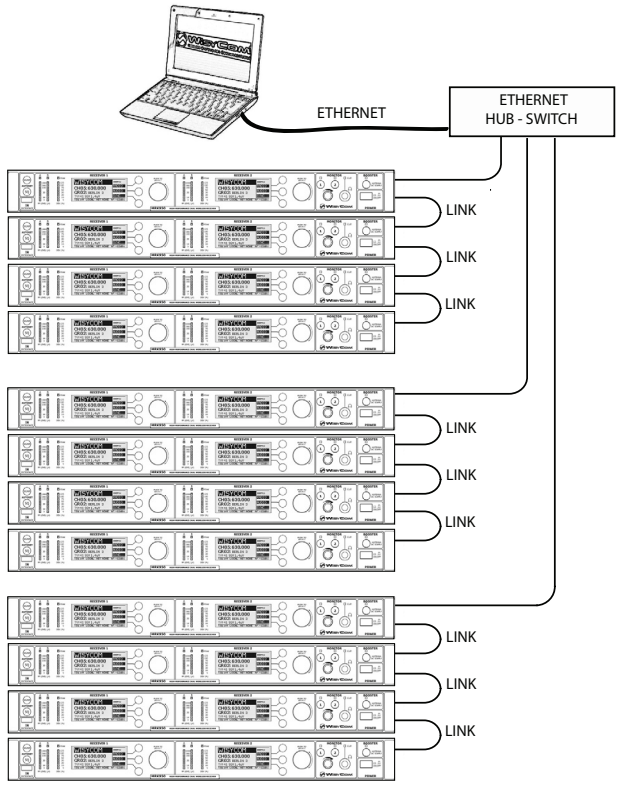


4 racks USB CASCADE(8 receiver):
the first is the subnet controller that control up to other 3 receiver. This entity is seen as single 8 receiver and using the ethernet port of the subnet controller can also be remoted in a computer network. This way the system has also the information on every single MRK960s location allowing very effective configuration and scene backup.

Note: it is not possible to connect more than 4 receivers MRK960 in a subnet USB

Several USB cascade can be connected using the ethernet connection on each MRK950 acting as cascade controller.

Hereafter an example of a 12 rack configuration, there is no limits to the complexity manageable on Wisycom Manager software.



Note: If using MRK960 with antenna cascade (using its integrated splitter), ***the MRK960 acting as "subnet controller" must be also the receiver connected with antennas and boosters***. This is to be able to manage and monitor voltage and current on antenna boosters.

Technical specification

- Two indipendent receivers tunable in all the specified frequency range
- Frequency range:
  - » **470/840 MHz (TV ch 21/62) with internal active splitter**
- Memorized channels: up to 2400 divided in 40 groups with 60 channels each
- Frequencies: microprocessor controlled PLL frequency synthesizer circuit, with 25 KHz minimum step (others on request)
- Frequency error: < ± 2.5 ppm, within the rated temperature range.
- Modulation: FM (50µs de-emphasis), other de-emphasis can be pre-set on request and can be recalled from the menu.
- Nominal deviation: ±40 KHz @ 1 KHz, ±65 KHz peak (Max acceptable deviation = ±80 KHz).
- "A" / "B" antenna inputs: with BNC type female connectors.
- "A" / "B" antenna input booster supply: 12Vdc 200mA max.
- RF input impedance: 50 ohm (SWR < 1:2)
- Sensitivity [with ENR]:
  - » < 0.9 µV (-1 dBµV), for SND/N = 52 dBA, in the whole switching-range [Rms value A weighted]
  - » < 10 µV (+20 dBµV), for SND/N = 115dBA, in the whole switching-range [Rms value A weighted]
- Amplitude response: < 0.2 dB (for RF input signal: +4 dBµV ÷ +120 dBµV)
- Co-channel rejection:
  - » > -3.5 dB @ 2 µVRF
  - » > -1.5 dB @ 100 µV RF
- Adjacent chan. selectivity: > 90dB @ ±300 KHz
- Spurious rec. rejection: > 90 dB
- IF image rejection: > 110 dB
- IIP3 (Input 3° order Intercept Point): > 20 dBm
- Spurious emissions: < 1pW (typ. = 0.1 pW)
- **DSP audio board,** 40bits floating point DSP processor for high dynamic range low noise multicompander audio processing and digital data detection. Thanks to the latest DSP class "shark" by Analog Design (2Gigaflops 40bit power), providing the highest audio quality (40bit floating point) and a delay of only 0,39 msec (AES3 output) and 0,46 msec (analogue output)
- Squelch :
  - » signal strength squelch: with menu adjustable threshold and "adaptive type" working: the receiver adapts itself automatically to different conditions of both medium strength and speed variation of the received signal;
  - » tone-squelch: it works by decoding the special key, sub-carrier (digitally modulated) present on the carrier of the actual Wisycom transmitters. The tone squelch function can be inhibited for compatibility with other types of transmitters.
- Tone-squelch: it works by decoding the special key, sub-carrier (digitally modulated) present on the carrier of the actual Wisycom transmitters. The tone squelch function can be inhibited for compatibility with other types of transmitters
- Noise Reduction system : compander circuit, can be pre-set (or switched off) to the following modes:
  - » ENR (Wisycom Extended-NR) as default
  - » CUSTOM (to be compatible with other brands transmitters)
- AF line output
  - » electrically balanced on XLR-3M connector (option XRL, transformer with 30 Ohm imp.)
  - » AF line output level: +12 dBu (3.1 Vrms) @ nominal deviation (could be individually attenuated by 30dB by means of a switch on the back panel under the XLR connectors)
  - » AF line output peak level: +20 dBu (7.75Vrms)
  - » AF line output connector: XLR, pin 1 could be grounded or floating by means of a switch on the back panel under the XLR connectors. Could withstand up to +52 Vdc of phantom supply
- AF bandwidth: 40 Hz ÷ 20 KHz
- Frequency response: < ±0.5 dB (±0.2 dB typ.) in the 50 Hz ÷ 19 KHz range
- Distortion: < 0.3 % (0.1 % typ.) @ peak deviation, ENR noise reduction system enabled
- SND/N ratio [1] > 115 dB (118 dB typ.) [2]
- Monitor output: 1/4" (6.3 mm) stereo jack connector
- Monitor output level: max 6 Vrms / 150 ohm
- Monitor out impedance: 100 ohm for auricle
- **AES/EBU (AES3)** board, externally synchronized:
  - » balanced transformer isolated output
  - » 24 bit professional audio stream
  - » word clock input from 32KHz to 108KHz, BNC connector
  - » word clock input impedance: 75Ω or high Z externally switchable
  - » word clock output on BNC connector for cascading more units
- Diversity technique: true-diversity (Twin receiver circuits)
- Bar-graph meters:
  - » RF field strengths (both "A" and "B" inputs)
  - » AF deviation (5% ÷ 150%), with peak-hold mode
- Displays: nr. 2, one each receiver, 64 x 256 OLED (yellow)
- Calibrating AF tone: 1 KHz, +12 dBu (other on request)
- Powering: 99 ÷ 138 Vac and 187 ÷ 264 Vac, with automatic switching / 100 VA max
- Temperature range: -10 ÷ + 55 °C
- Dimensions: 19"/1U, depth 370mm
- 2 USBs type A/B for network connection and devices cascade
- 10/100 Base TX Ethernet port on RJ45 connector

Options specifications:

- **Low impedance transformer on audio lines (option XRL950, XRC950):** Analog audio outputs are galvanically isolated by means of a high quality low impedance shielded transformers.
  - » output level: 12dBu nom., 18dBu at max FM deviation
  - » output impedance: < 30Ω (e.g. could drive at least 300m of high quality twisted pair audio cable without degradation in frequency response)
- **COM audio output (option PTT950)**: same specifications as LINE audio output
- **GPI output (option PTT950)**: normally open opto-relay isolated output,
  - » AC/DC 56Vpk max - 100mAmax.
  - » 10 ohm max on resistance.
  - » 1/4" (6.3 mm) stereo jack connector (2 pins for relay contact + receiver ground)
- **Ethersound® (option ETS950)**: interface enable the connection of the MRK950EX on a Ethersound® network for multichannel digital audio distribution on a single cat.5 Ethernet compatible cable.
  - » Needs DSP audio board installed.
  - » Two RJ45 connectors for input and output data lines

ENVIRONMENTAL INFORMATION

Applicable in the European Union and other European countries with separate collection systems

Disposal of Old Electrical & Electronic Equipment (2002/96/EC)

This symbol indicates that this products shall not be treated as household waste. Instead it shall be handed over to the appropriate collection point for the recycling of electrical and electronic equipment. The recycling of material will help to conserve natural resources.

ITALY ONLY

Obblighi di informazione agli utilizzatori

ai sensi dell'art. 13 del Decreto Legislativo 25 luglio 2005, n. 151 "Attuazione delle Direttive 2002/95/CE, 2002/96/CE e 2003/108/CE, relative alla riduzione dell'uso di sostanze pericolose nelle apparecchiature elettriche ed elettroniche, nonché allo smaltimento dei rifiuti"

Smaltimento di apparecchiature elettriche ed elettroniche di tipo professionale

Il simbolo del cassonetto barrato riportato sull'apparecchiatura o sulla sua confezione indica che il prodotto alla fine della propria vita utile deve essere raccolto separatamente dagli altri rifiuti.

La raccolta differenziata della presente apparecchia¬tura giunta a fine vita è organizzata e gestita dal produttore. L'utente che vorrà disfarsi della presente apparecchiatura dovrà quindi contattare il produt¬tore e seguire il sistema che questo ha adottato per consentire la raccolta separata dell'apparecchiatura giunta a fine vita.

L'adeguata raccolta differenziata per l'avvio succes¬sivo dell'apparecchiatura dismessa al riciclaggio, al trattamento e allo smaltimento ambientalmente compatibile contribuisce ad evitare possibili effetti negativi sull'ambiente e sulla salute e favorisce il re¬impiego e/o riciclo dei materiali di cui è composta l'apparecchiatura.

Lo smaltimento abusivo del prodotto da parte del detentore comporta l'applicazione delle sanzioni am¬ministrative previste dalla normativa vigente.

Iscrizione al Registro A.E.E. n. IT09100000006319

CE

The MRK 960 Receiver System complies with ETSI ETS 300 422.

Subject to Change without notice

DECLARATION OF CONFORMITY

Manufacturer Name: WISYCOM S.r.l.

Manufacturer Address: via Spin, 156
36060 Romano d'Ezzelino (VI)
Italy

Herewith we declare that

Product Type : Dual diversity receivers for professional wireless microphone system

Product Name : MRK 960

Optional and Accessories: This declaration includes all the options and accessories included into the product.

We declare that the above mentioned product is compliant with 89/336/EEC EMC directive.

☒	EN 60065	Safety requirements for mains operated electronic and related apparatus for household and similar general use.
☒	ETS 300 422	Electromagnetic compatibility and Radio spectrum Matters (ERM); Wireless microphones in the 25 MHz to 3 GHz frequency range.
☒	ETS 300 445	Radio Equipment and Systems (RES); Electro-Magnetic Compatibility (EMC) standard for wireless microphones and similar Radio Frequency (RF) audio link equipment.
☒	ETS 301 489	Electromagnetic Compatibility and Radio spectrum Matters (ERM); ElectroMagnetic Compatibility (EMC) standard for radio equipment and services.

The conformity is achieved by fulfilling the following European Standard(s):

WISYCOM s.r.l.
Franco Maestrelli
Amministratore Unico

Romano d'Ezzelino (VI)	10-DEC-11
Address	**Data**

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